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"Scarless" Inguinal Herniorrhaphy

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ABSTRACT

Introduction: Laparoscopic inguinal herniorrhaphy is widely accepted. Robotic-assisted surgery provides improved 3-dimensional visualization and enhanced dexterity. The purpose of this case series was to demonstrate the feasibility of a modified, robotic, single-site, unilateral inguinal herniorrhaphy.

Technique: Six patients 18 years of age or older with a body mass index <35 provided informed consent and underwent hernia repair with a modified herniorrhaphy technique from January to July 2014. Eight patients were screened and six case experiences are described in this series. The da Vinci Si robot, gel port, and instruments (Intuitive Surgical, Sunnyvale, California, USA) were used. With the patient in Trendelenburg position, a 25-mm incision was made within the umbilicus. The fascia was incised, and the peritoneal cavity was entered. A robotic cholecystectomy gel port was placed. Robotic instruments were inserted, and the robot was docked. A preperitoneal flap was raised on the affected side with the robotic instruments used interchangeably. The hernia sac was identified and reduced, and the mesh was tacked in place. The preperitoneal flap was tacked back in place. The robot was undocked, the abdomen was desufflated, and the fascia was closed.

Discussion: Single-site unilateral inguinal herniorrhaphy was performed for 6 patients. All patients were discharged the same day, had good aesthetic results, and experienced no hernia recurrence. Robotic single-site gel port inguinal herniorrhaphy is feasible and appears as safe and time efficient as laparoscopic herniorrhaphy in this small group.

Key Words: Inguinal herniorrhaphy, Robotic herniorrhaphy, Single-site surgery, TAPP herniorrhaphy.

INTRODUCTION

Laparoscopic approaches to inguinal hernia repair including transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) have been described since the 1990s.[1–4] Potential advantages of TAPP and TEP repair over conventional open repair include less pain, less surgical trauma, and faster return to daily activities.[5,6] A recent analysis of over 17,000 unilateral inguinal hernia repairs showed no significant difference in intraoperative complications, general postoperative complications, and reoperation rates between TAPP and TEP techniques.[7]

Single-incision laparoscopic surgery, first reported in 2009,[8] is an exciting innovation.[9–10] The main premise of single-port surgery is the use of completely blunt ports, which mitigates the risk of bowel and vascular injuries related to sharp secondary trocars in the traditional 3-port surgery.

The single-site technology offered by the da Vinci robotic platform (Intuitive Surgical, Sunnyvale, California, USA) enables peritoneal access through a 25-mm incision. Robotic optics and instrumentation allow for precise dissection of the preperitoneal groin anatomy, as well as wide exposure of all potential inguinal defects.[9]

The purpose of this case series was to show that TAPP robotic single-site inguinal hernia repair with a cholecystectomy gel port is feasible and safe and provides desirable aesthetic results. A retrospective study by Engan and colleagues[9] described a similar method of inguinal hernia repair through an epigastric incision. In addition, Tran[10] investigated robotic single-port TEP inguinal hernia repair via an umbilical incision. However, the present account describes TAPP procedures performed solely through the umbilicus. This series is important, because the modified approach confers the extra benefit of cosmesis, along with

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Disclosures: None.

The single-site gel port described in this surgical technique is approved by the FDA for cholecystectomy but is not labeled for the use described in this technique.

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reasonable time efficiency, and the potential to perform combined and or complex procedures through the same incision.

CASE DESCRIPTIONS

This study was an Institutional Review Board–approved prospective case series. Patients were considered for the modified technique if they were 18 years of age and older, had a body mass index (BMI) <35, had a clinically diagnosed inguinal hernia, and were able to provide informed consent. Patients were excluded if they had a history of abdominal surgery, American Society of Anesthesiologists (ASA) class ≥4, or if the hernia was not surgically confirmed. From January to July, 2014, eight patients were screened, and 6 were included and described in this case series.

The da Vinci Si robot, the robotic instrumentation, and the cholecystectomy gel port (Intuitive surgical) were used in all cases. The single-site gel port described in this surgical technique is approved by the U.S. Food and Drug Administration for cholecystectomy, but not labeled for the use described in this technique. The laparoscopic grasper used was Snowden-Pencer (CareFusion, Tucker, Georgia, USA).

The cholecystectomy gel port has 4 openings: 1 for the camera, 2 for the robotic instruments, and the fourth for the assistant port. The first 3 ports are strictly controlled by the robot. The assistant port is used for nonrobotic laparoscopic instruments, or to assist with dissection. **Figure 1** shows a graphic representation of the single-site set-up.

Technique

The first 3 patients underwent single-site robotic repair with a laparoscopic grasper via the assistant port, and the

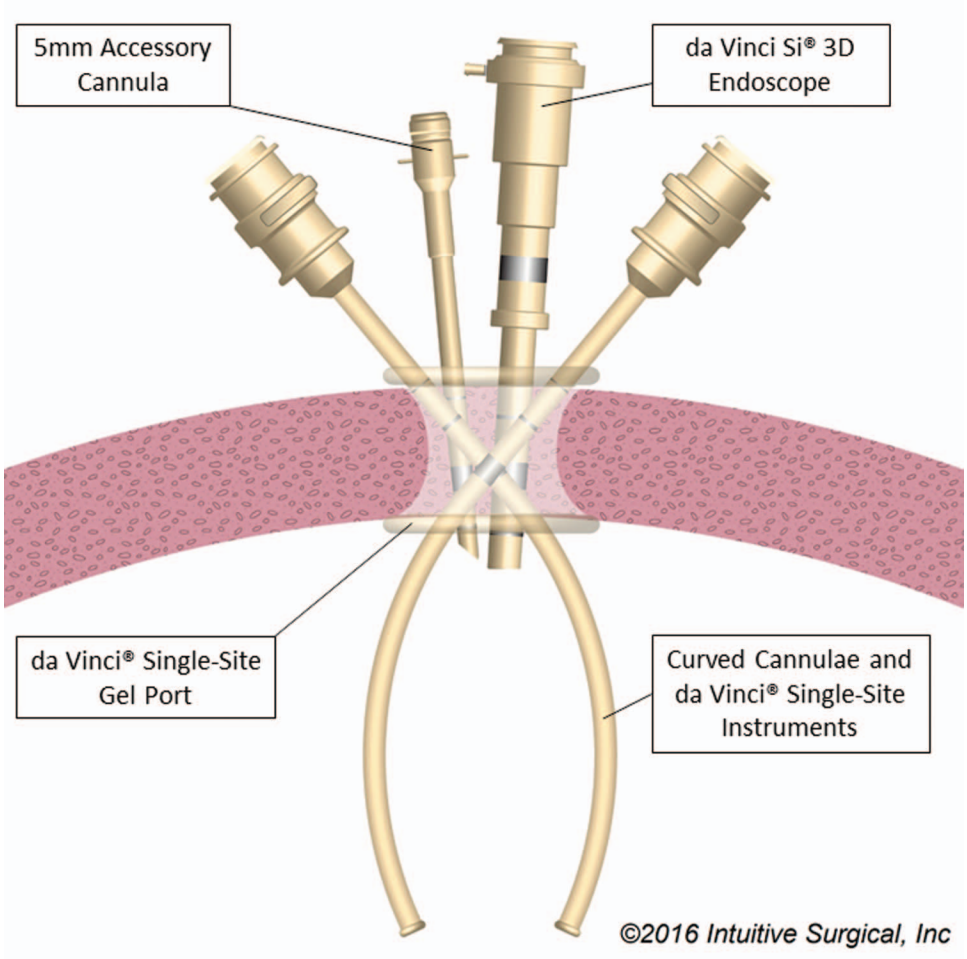

Figure 1. Graphic representation of the single-site set-up. ©2016 Intuitive Surgical, Inc. Figure reprinted with permission.

last 3 had procedures performed solely robotically. Patients were prepped and draped in a normal sterile fashion and a urinary catheter was inserted with the patient under general anesthesia. A 25-mm incision was made through the umbilicus, and the cholecystectomy robotic gel port was placed transfascially. The peritoneum was insufflated to 15 mm Hg. The patient was then placed in Trendelenburg position, with the head turned away from the robot and the feet toward the robot. Using the short (250 mm) robotic cannulae, all the trocars were sequentially inserted under direct visualization. The cannulae tips were placed 3 cm infraumbilically. In the first 3 cases, the laparoscopic grasper was inserted through the assistant port within the robotic gel port. The robot was docked from the patient's foot upon the ipsilateral hernia site.

All cases used an 8-mm, 30-degree camera in the upward position. **Figure 2** depicts a hernia defect before dissection. Dissection started with hook cautery and a Maryland dissector used to raise a transverse peritoneal flap at 6 cm below the umbilicus, beginning from the midline, moving laterally to the anterior superior iliac spine. In the first 3 cases, a laparoscopic grasper assisted dissection via the assistant port. Blunt dissection continued down to the hernia sac with the help of the shears and fundus grasper. Alternating among the crocodile grasper, fundus grasper, and robotic shears, the surgeon freed the hernia sac (**Figure 3**) from the round ligament in female patients and from the vas deferens and testicular vessels in male patients. The dissection was facilitated by the curvability of the robotic instruments and exposed the symphysis pubis medially and Cooper's ligament and the femoral canal posteromedially (**Figure 4**). Once the hernia was completely reduced (**Figure 5**), a Bard 3DMax mesh (C.R. Bard Inc., Cranston, Rhode Island, USA) was introduced through the camera port. It was unrolled with a combination of the robotic graspers and, in the first 3 cases, a laparoscopic grasper through the assistant port and placed over the pubic tubercle with a 2-cm overlap. With the robotic graspers, the mesh was stabilized in position, while a SecureStrap (Ethicon Inc., Bridgewater, New Jersey, USA) absorbable tacker was introduced through the assistant port and used to tack the mesh (**Figure 6**). The assistant port was used for tacker placement in all 6 cases, because the instrument is not available robotically.

Figure 2. Intraoperative photograph depicting a hernia defect.

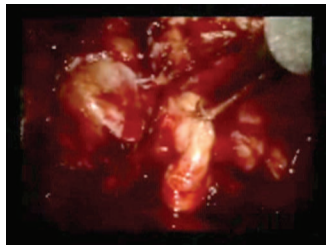

Figure 3. Intraoperative photograph at the start of dissection. Note the instrument holding the hernia sac.

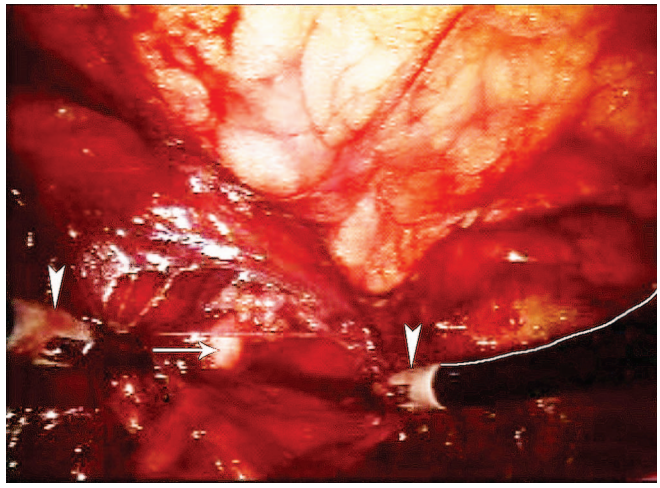

Figure 4. Intraoperative photograph demonstrating the robotic graspers (arrowheads) during dissection. The instrument curvability (linear line on right grasper) maximizes dissection in a single-port scenario. The vas is depicted in the center (full arrow) after dissection of the hernia sac.

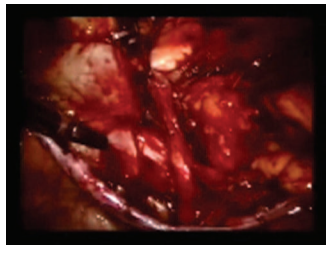

Figure 5. Intraoperative photograph at the end of dissection, just before mesh placement.

Finally, the peritoneum was closed over the mesh with the tacker (**Figure 7**). The robot was undocked, the cannulae and gel port removed, and the pneumoperitoneum evac-

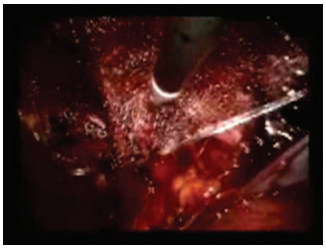

Figure 6. Intraoperative photograph depicting the mesh in place over the reduced hernia. Notice the tacker over Cooper's ligament.

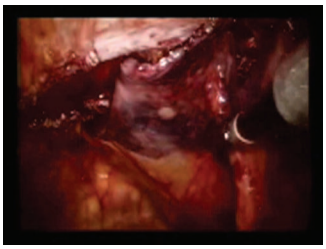

Figure 7. Intraoperative photograph of the peritoneal flap being reapplied over the mesh.

uated. The fascia was closed with no. 0 Vicryl sutures in a figure-of-eight fashion. The skin was closed with subcuticular 4-0 Vicryl sutures then Dermabond (Ethicon Inc., Bridgewater, NJ, USA) was applied (**Figure 8**). The urinary catheter was removed, and the patient was observed in the recovery room, discharged the same day with a 2-week supply of narcotic pain medication, and instructed to follow up in 2 weeks.

DISCUSSION

The average procedure length was 121.3 minutes (range, 77–162), inclusive of the docking time, which took ~20 minutes. The average patient age was 39.3 years (range, 23–65), and the mean BMI was 25.3 kg/m^2 (range, 18.6–33.28). There were 5 ASA II patients and 1 ASA III patient.

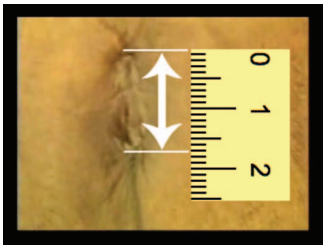

Figure 8. Photograph of the umbilical skin defect, immediately after surgery. Notice the small scar.

Three cases had indirect hernias, 1 direct hernia, 1 femoral hernia, and 1 direct and indirect hernia.

In the first group of patients who had an assistant port use for dissection, there was 1 postoperative complication of scrotal swelling that required no intervention and resolved by the 2-week follow-up. In the group of patients whose procedures were performed solely robotically, there were no postoperative complications. All patients reported minimal pain 2 weeks after surgery and good aesthetic results (**Figure 9**) and had no hernia recurrence at the final 1-month follow-up. No patients returned for hernia-related complaints or hernia recurrence.

These cases demonstrate that TAPP single-site robot-assisted unilateral inguinal hernia repair can be successfully performed without intraoperative complications. In the first 3 cases, laparoscopic graspers via the assistant port were used for peritoneal flap and hernia sac dissection. As confidence in using the robotic instruments increased, the use of the laparoscopic grasper for dissection was eliminated, and the last 3 surgeries were performed exclusively robotically, with the exception of the tacker placement.

The investigating surgeon chose to use a tacker as opposed to applying the mesh and closing the peritoneum, because tacker placement is the standard approach for all of the investigating surgeon's laparoscopic and robotic herniorrhaphy cases, including those requiring mesh. Two surgeons have reported using a tacker in their single-site robotic techniques.[9–10] One reported using a tacker throughout all cases,[10] and another reported tacker placement during the beginning of their case series and transitioning to sewing in the mesh after several cases.[9] Sewing in the mesh and closing the peritoneum rather than using

Figure 9. Photograph of a healing umbilical incision, 2 weeks after surgery.

a tacker seems reasonable for this surgical approach, but not required for successful procedures.

In addition, the use of bipolar or unipolar cautery is a technique preference and varies from surgeon to surgeon. Because the investigating surgeon's standard laparoscopic and robotic technique uses unipolar cautery to open the peritoneum, it was also used for this modified single-site technique. One group described using unipolar cautery in their technique,[9] whereas other modified techniques did not specify the cautery type.[8,10] As with tacker placement, this is simply a technique preference.

It is worth noting that this series took place at a teaching hospital with a surgical residency program, and the variance in procedure time can be partially attributed to teaching time between the attending and resident surgeons. Yet this highlights the short learning period needed to adopt the approach: in 3 cases the surgeon felt confident enough to perform the procedure exclusively with robotics. We anticipate that, as the frequency of this technique increases, the operative time will decrease to either match or be less than the robotic multiport inguinal herniorrhaphy.

A similar TAPP robotic herniorrhaphy technique was described by Engan and colleagues[9] via an epigastric incision. That group reported a 63-minute operative time for unilateral herniorrhaphy. Tran[10] investigated robotic single-site TEP through an umbilical incision and reported a 48-minute operative time. Both groups' operative times were significantly less than the current surgeon's 121-minute operative time. This can be explained by sample sizes; Engan et al and Tran included at least 30 patients, whereas the current investigation included only 6. Another single-incision laparoscopic TEP technique was described by Filipovic-Cugura and colleagues,[8] who used an infraumbilical incision, but without robotics. The current technique is unique, because it describes "scarless" TAPP robotic inguinal herniorrhaphy with an approach via an umbilical incision. Although larger randomized, controlled studies would have to be conducted to determine overall safety and long-term outcomes in a more heterogeneous patient population, these initial cases demonstrate the feasibility of the technique and the potential future direction of robotic surgery.

All patients in this case series incurred the benefit of single-site robotic-assisted hernia repair—namely, minimal pain at 2 week follow-up, no hernia recurrence, and "scarless" surgery, with the incision completely concealed within the umbilicus.

Robotic single-site gel port inguinal hernia repair via the umbilicus appears as safe and has the potential to be as time efficient as laparoscopic repair and other robot-assisted techniques, but with improved cosmetic results. This technique opens the platform for combined cases and more complex cases to evolve into single-site robotic surgery through a single umbilical incision.

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